LDCM Science Overview

presented by

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Mission Operations Element Industry Day
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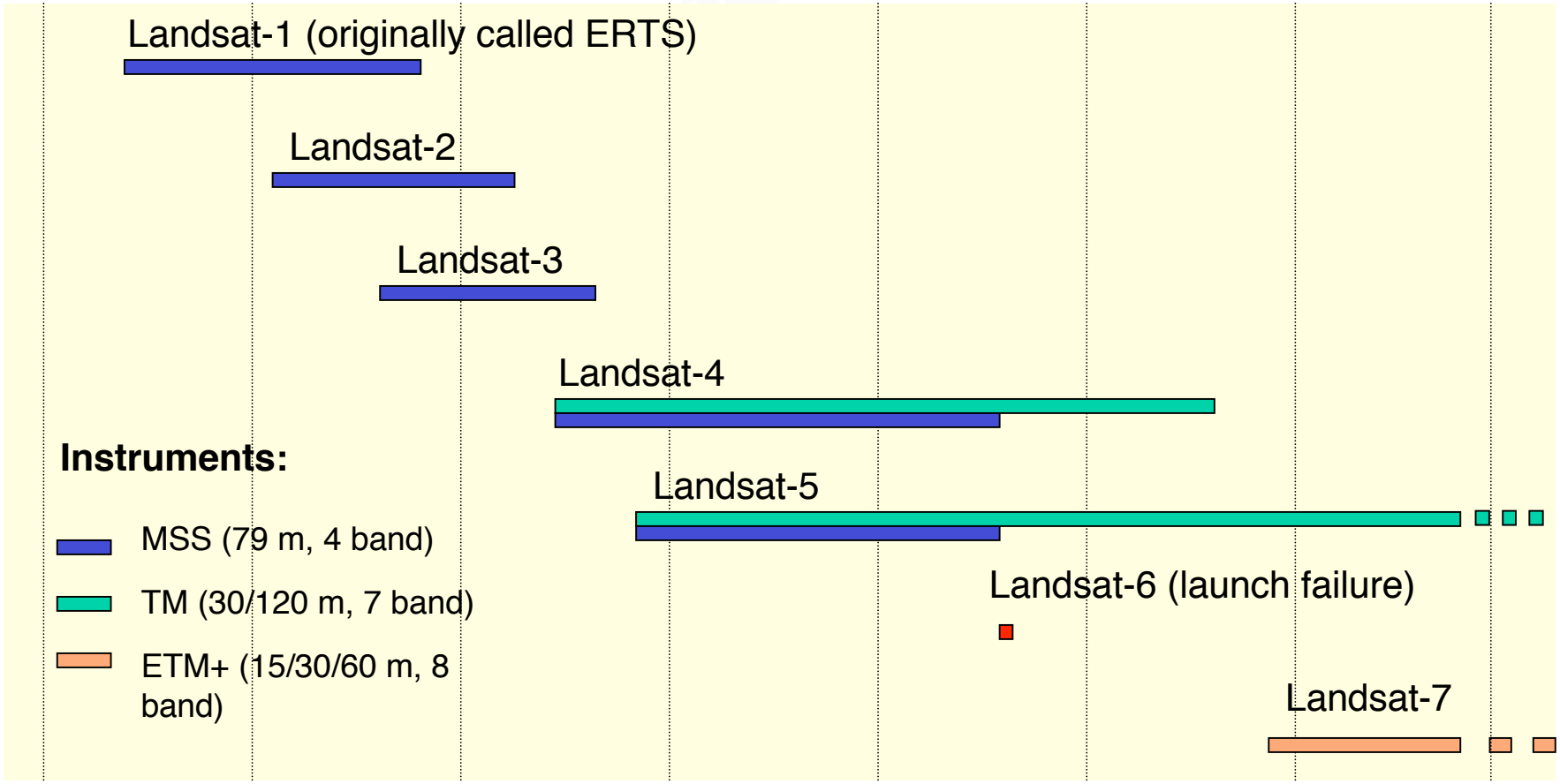
History of the Landsat Program

LDCM

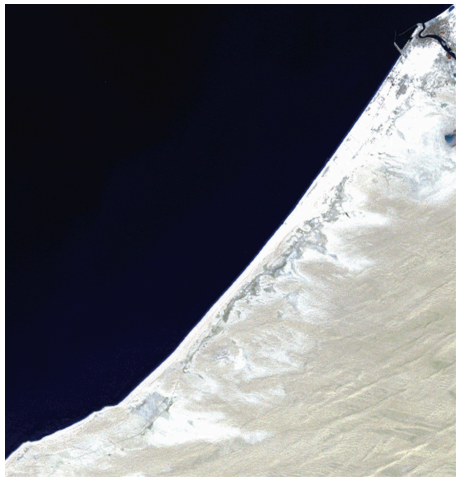


Importance of Landsat Data Continuity

Land cover and land use are changing at rates unprecedented in human history with profound societal consequences

- –Food and fiber production
- –Water consumption and quality
- –Weather and climate change
- –Human health

Dubai, United Arab Emirates



Landsat 1 MSS, 1973

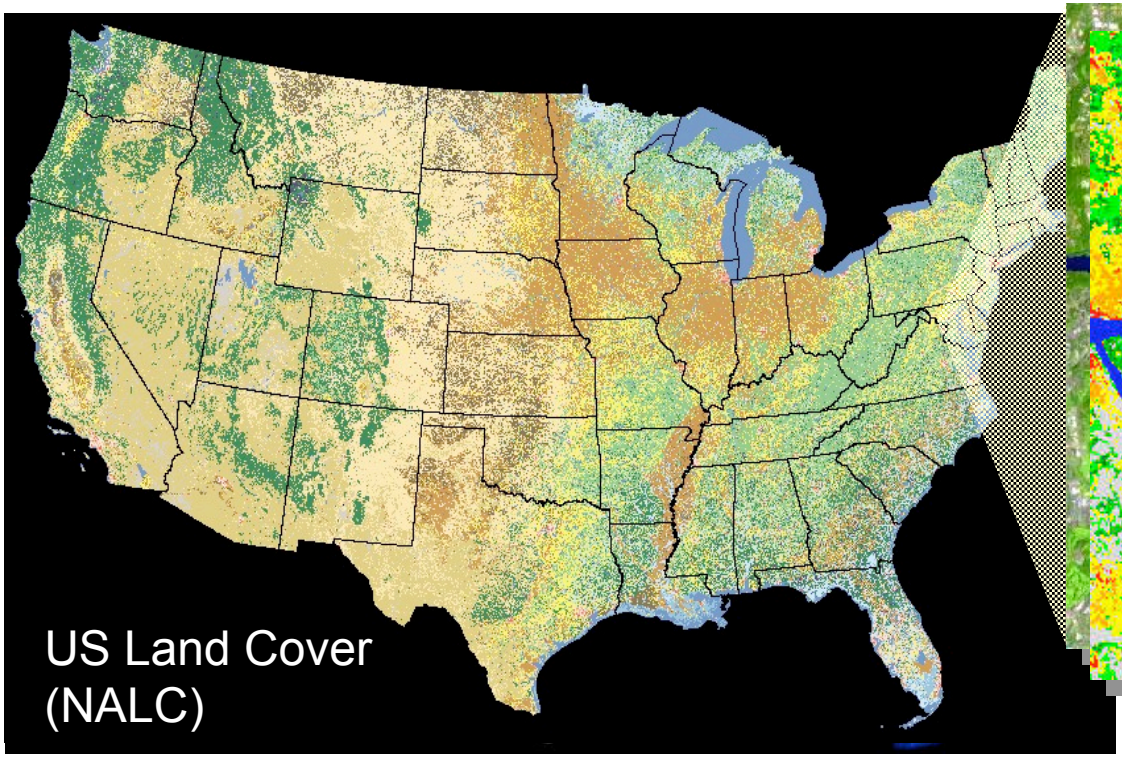
Landsat 4 TM, 1990

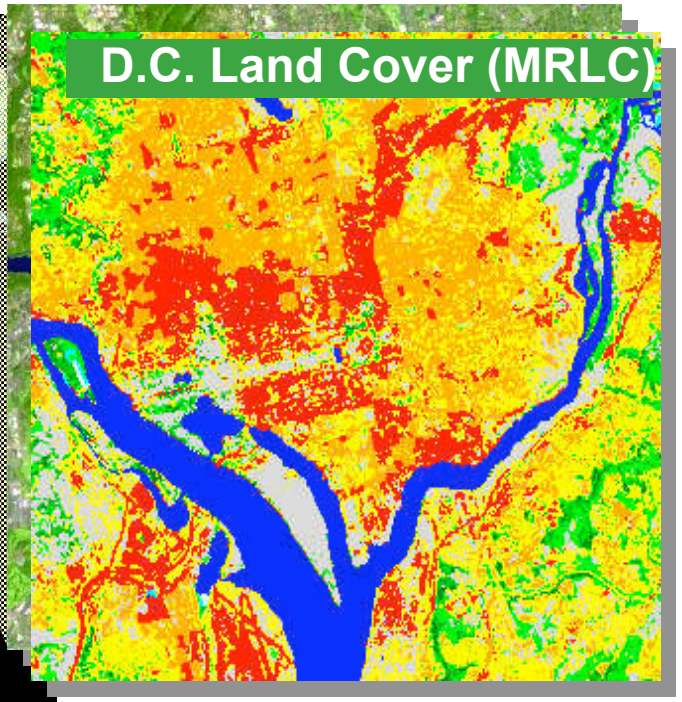
Landsat 7 ETM+, 2006

Land Cover Type

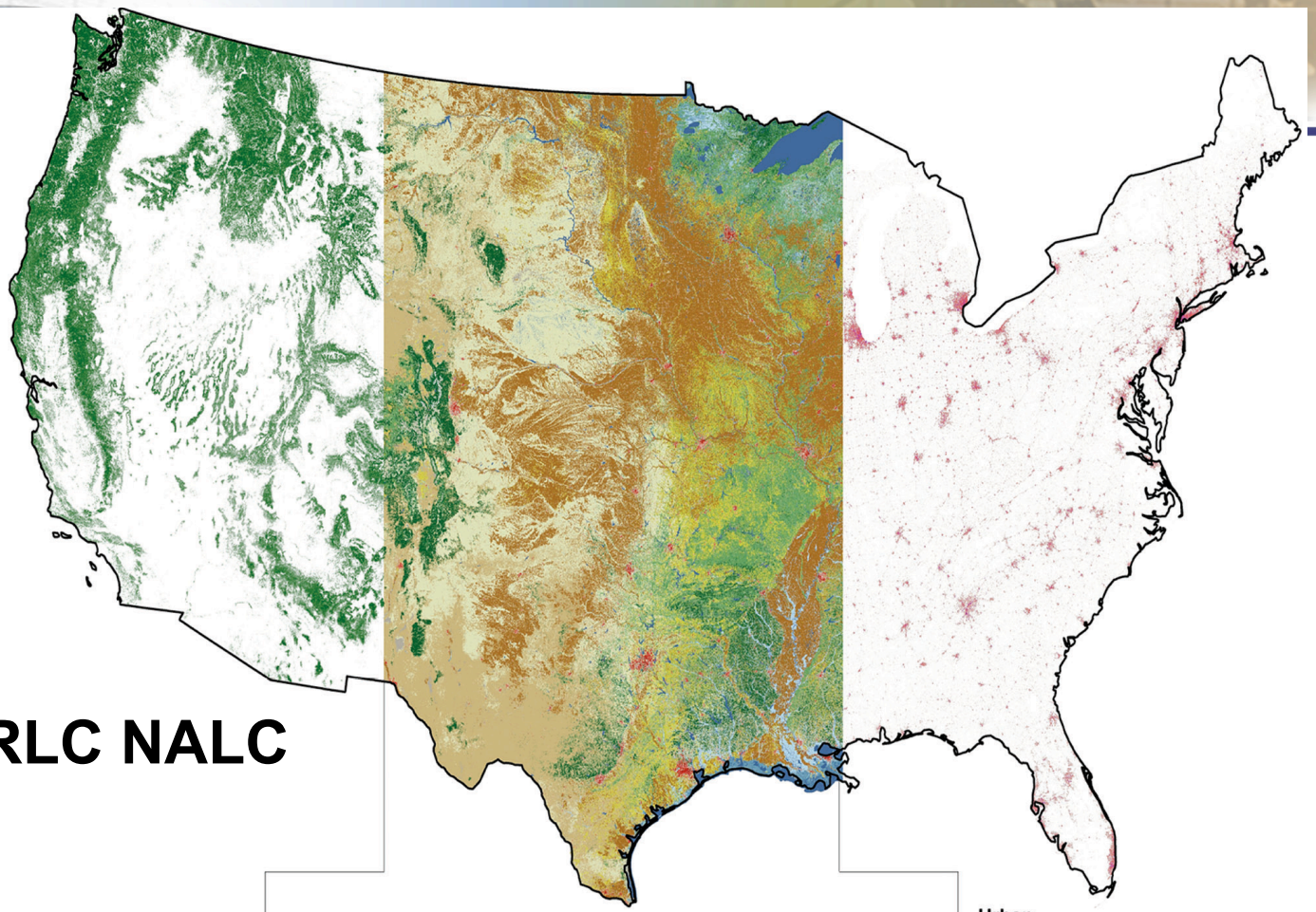
The Landsat Mission has produced a 30+ year record of global land cover at a resolution sufficient to show the impact human activities.

Land-cover and its change are principal drivers of climate change, ecosystem health, biogeochemical and hydrological cycles, with clear connections to human sustainability.





2001 MRLC NALC



Tree canopy

- 1 to 10%
- 11 to 20%
- 21 to 30%
- 31 to 40%
- 41 to 50%
- 51 to 60%
- 61 to 70%
- 71 to 80%
- 81 to 90%
- 91 to 100%

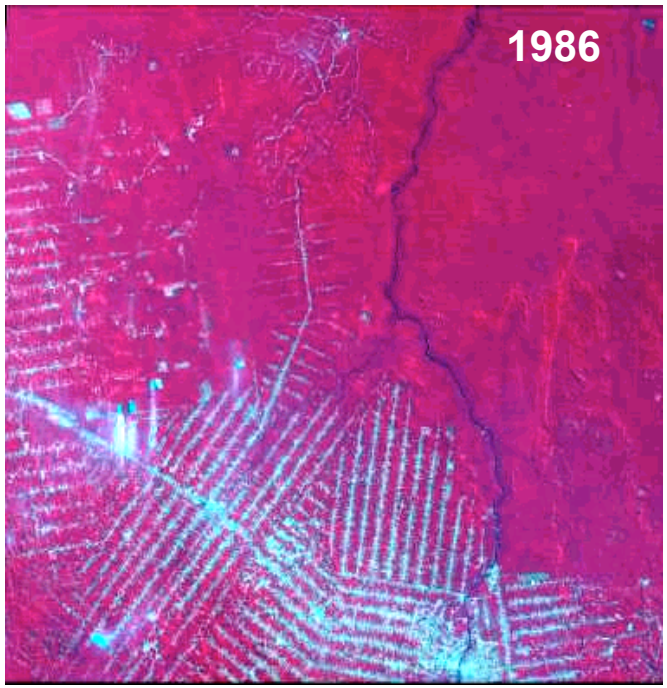
Land Cover Class Value and Description

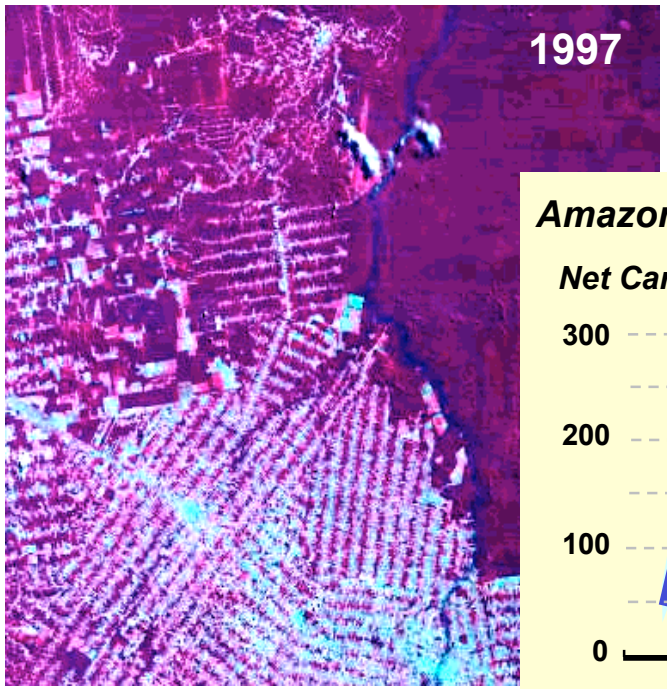
- (11) Open Water
- (12) Perennial Ice/Snow
- (21) Developed, Open Space
- (22) Developed, Low Intensity
- (23) Developed, Medium Intensity
- (24) Developed, High Intensity
- (31) Barren Land
- (41) Deciduous Forest
- (42) Evergreen Forest
- (43) Mixed Forest
- (52) Shrub/Scrub
- (71) Grassland/Herbaceous
- (81) Hay/Pasture
- (82) Cultivated Crops
- (90) Woody Wetlands
- (95) Emergent Herbaceous Wetlands

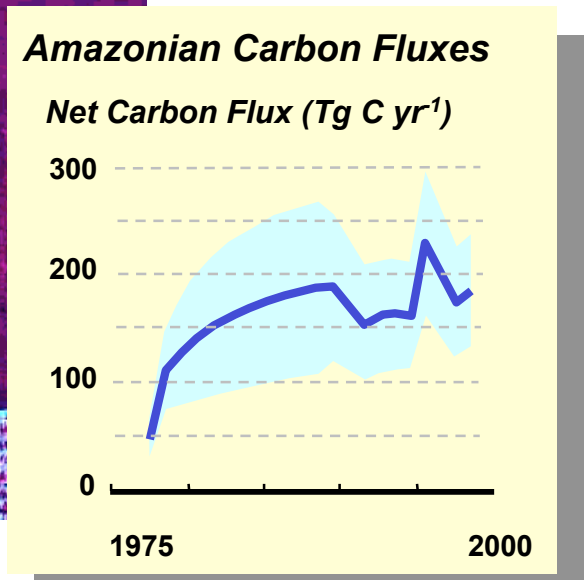
Urban Imperviousness

- 1 to 10%
- 11 to 20%
- 21 to 30%
- 31 to 40%
- 41 to 50%
- 51 to 60%
- 61 to 70%
- 71 to 80%
- 81 to 90%
- 91 to 100%

Example: Tropical Deforestation

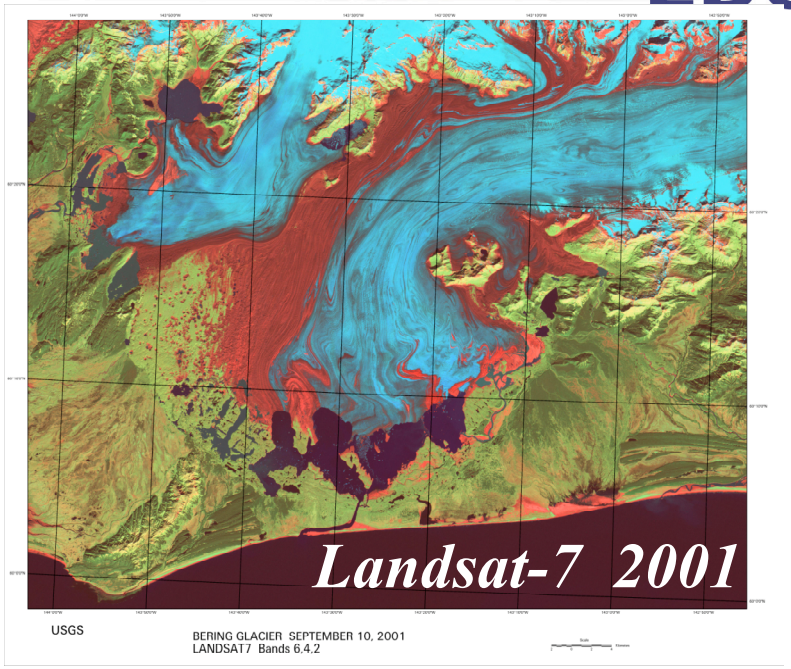






Courtesy TRFIC–MSU, Houghton et al, 2000.

Change in Bering Glacier, Alaska

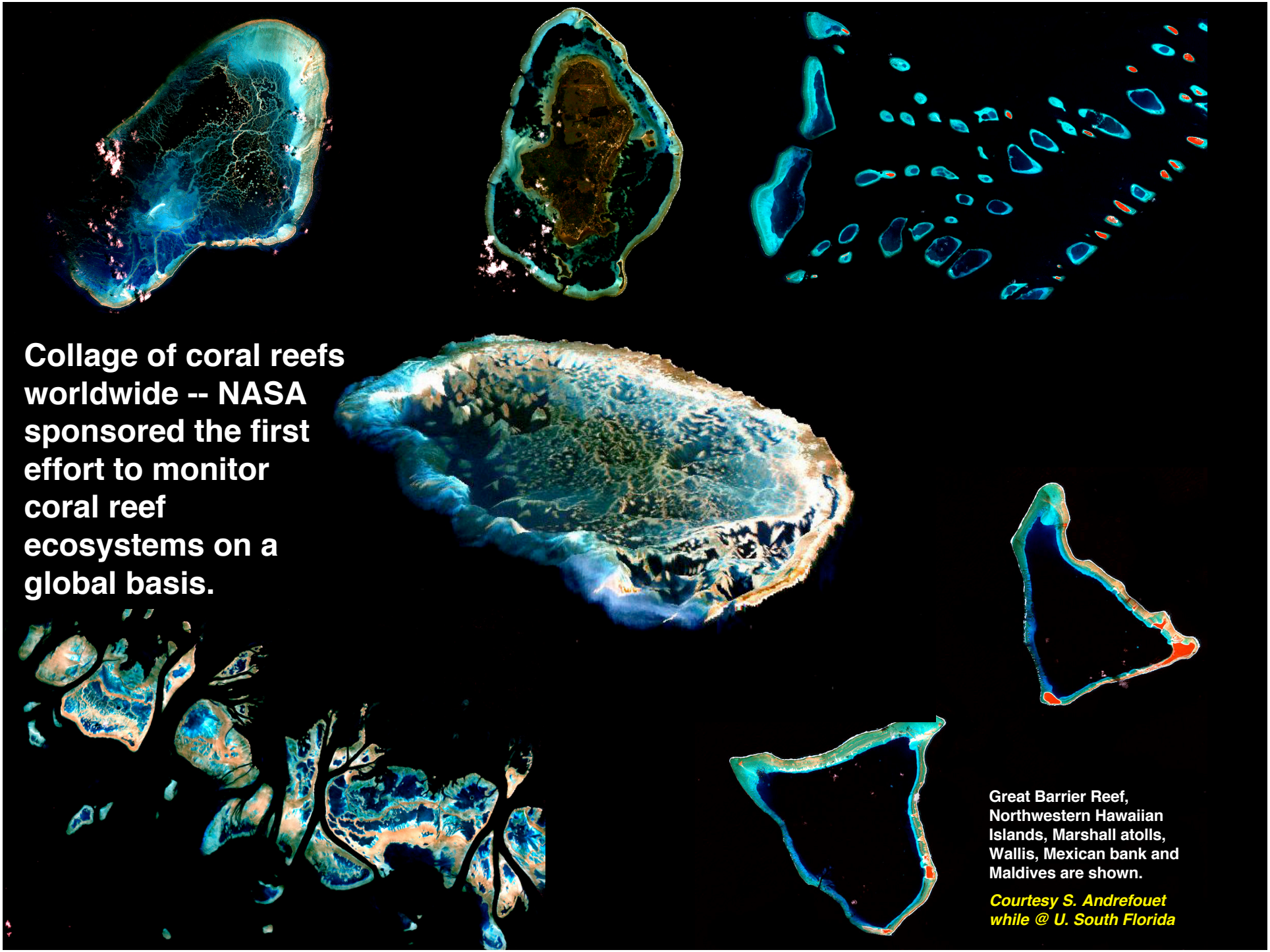


Changes in glacier extents are visible in Landsat imagery

Worldwide, most glaciers are in retreat, probably leading to a significant part of the measured rate of sea-level rise.

Glacial unloading may also induce tectonic stress, triggering earthquake activity.

(Courtesy of J. Sauber, NASA GSFC)

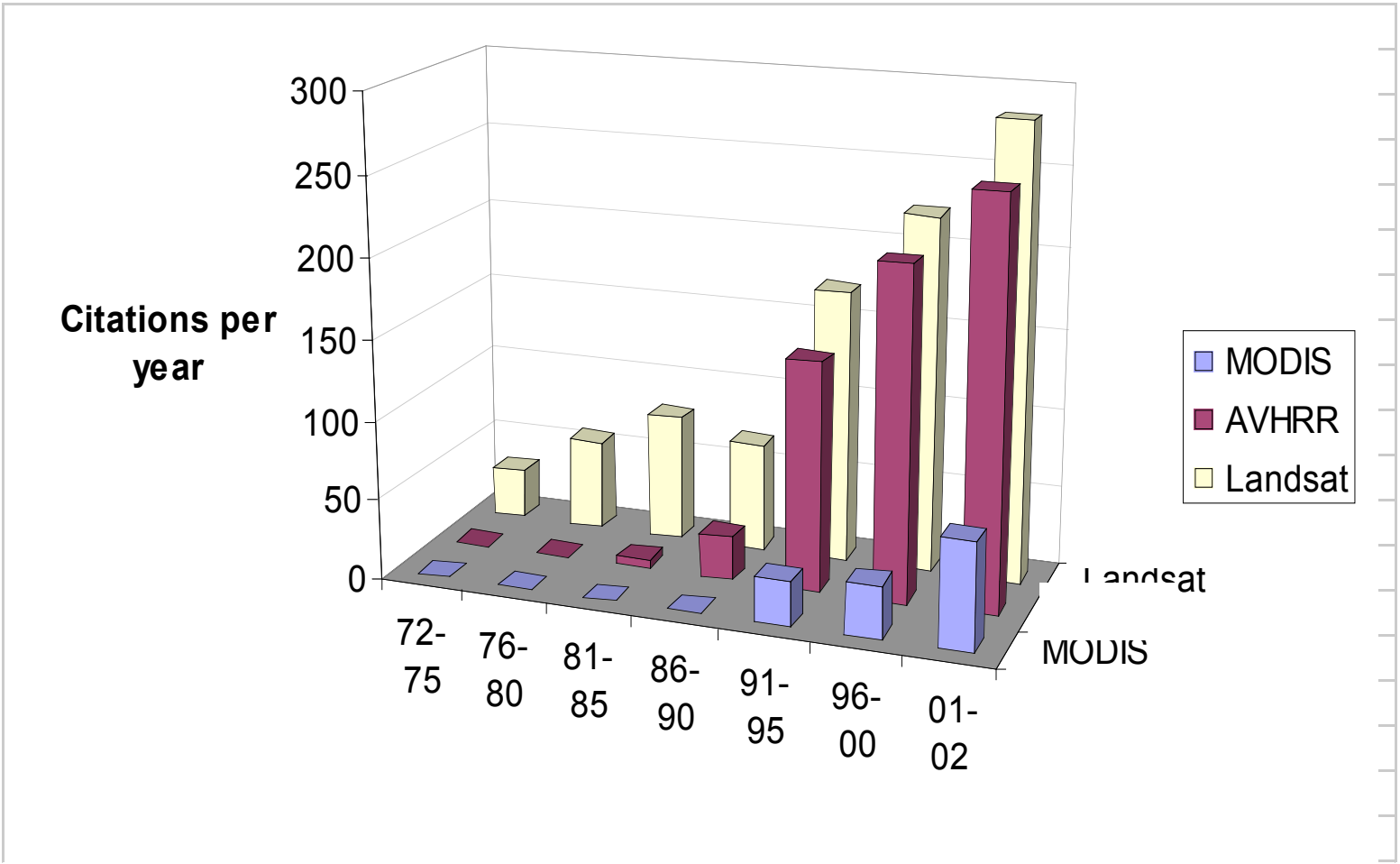


Collage of coral reefs worldwide -- NASA sponsored the first effort to monitor coral reef ecosystems on a global basis.

Great Barrier Reef, Northwestern Hawaiian Islands, Marshall atolls, Wallis, Mexican bank and Maldives are shown.

Courtesy S. Andrefouet while @ U. South Florida

Landsat is the most widely cited remote sensing system in the peer-reviewed literature.



Source: Science citation index

Science Role of LDCM

- **The scientific integrity of the Landsat program derives not only from current sensor observations, but also from:**
  - **Rigorous calibration / cross-calibration**
  - **A long-term data archive**
    - The DoI / USGS preserves a 33-yr archive of Landsat data in the National Satellite Land Remote Sensing Data Archive (NSLRSDA) at USGS EROS, Sioux Falls, SD
    - DoI is the only federal agency with a mandate to preserve this archive for public access (the Land Remote Sensing Policy Act of 1992)
    - No other nation is committed to preserving a comparable record of the global land surface
  - **A global data acquisition strategy**
    - No other nation's satellite system is designed or operated to achieve even annual global coverage at the Landsat scale
  - **An open data policy**
    - DoI provides non-discriminatory public access to the Landsat data archive
    - No restrictions are placed on Landsat data sharing

OLI Specifications

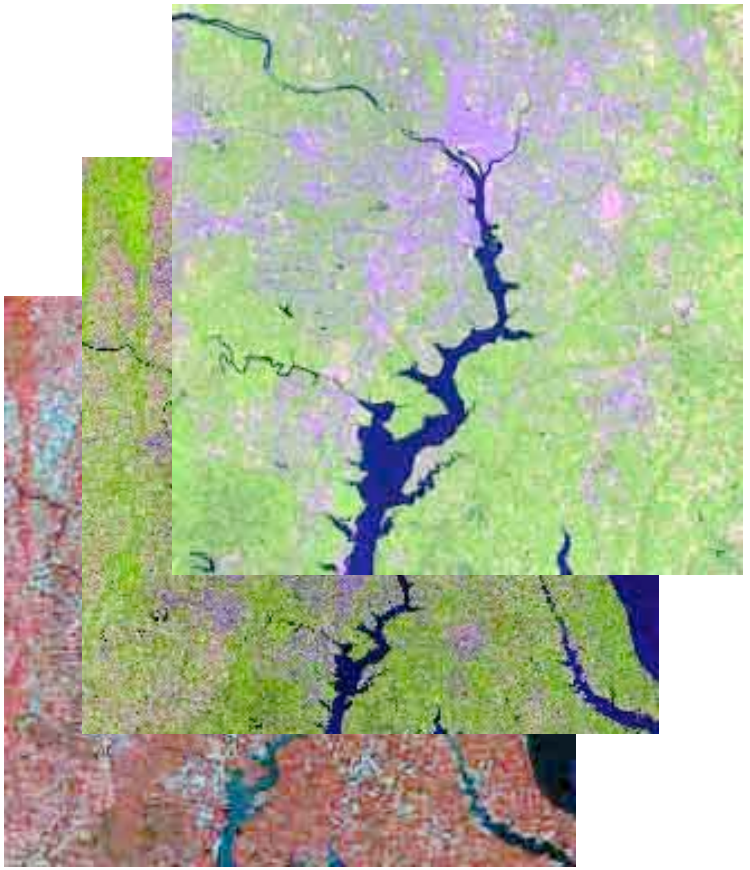
Table 1. Required Spectral Bands and Spatial Resolution

#	Band	Minimum Lower Band Edge (nm)	Maximum Upper Band Edge (nm)	Center Wavelength (nm)	Maximum Spatial Resolution At Nadir (m)
1	Coastal /Aerosol	433	453	443	30
2	Blue	450	515	482	30
3	Green	525	600	562	30
4	Red	630	680	655	30
5	NIR	845	885	865	30
6	SWIR 1	1560	1660	1610	30
7	SWIR 2	2100	2300	2200	30
8	Panchromatic	500	680	590	15
9	Cirrus	1360	1390	1375	30

U.S.G.S. EROS Landsat Archive Overview

(Marketable Scenes through September 25, 2006)

- **ETM+: Landsat 7**
  - 654,932 scenes
  - 608TB RCC and L0Ra Data
  - Archive grows by 260GB Daily
- **TM: Landsat 4 & Landsat 5**
  - 671,646 scenes
  - 336TB of RCC and L0Ra Data
  - Archive Grows by 40GB Daily
- **MSS: Landsat 1 through 5**
  - 641,555 scenes
  - 14TB of Data



Archive reached 2 million scenes on Feb. 20, 2007

Landsat Science Team

- **USGS convened the first meeting of the USGS-sponsored science team for Jan. 09 - 11 at USGS EROS in Sioux Falls, SD**
  - **Co-chaired by the USGS Landsat Project Scientist, Tom Loveland, and the NASA LDCM Project Scientist, Jim Irons**
  - **USGS selected 17 science team members in Oct.**
    - 8 funded PI's from academia and private industry
    - 6 unfunded civil servant PI's and 3 unfunded international PI's
  - **Team selected Curtis Woodcock, Boston U., as Team Leader**
    - Woodcock signed and sent the thermal imaging letter to NASA Administrator and USGS Director on behalf of Science Team